

The Soil Conservation Connection

National Adaptation Forum

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One of the Problems

The challenge to produce enough food will be greater over the next 50 years than in all human history

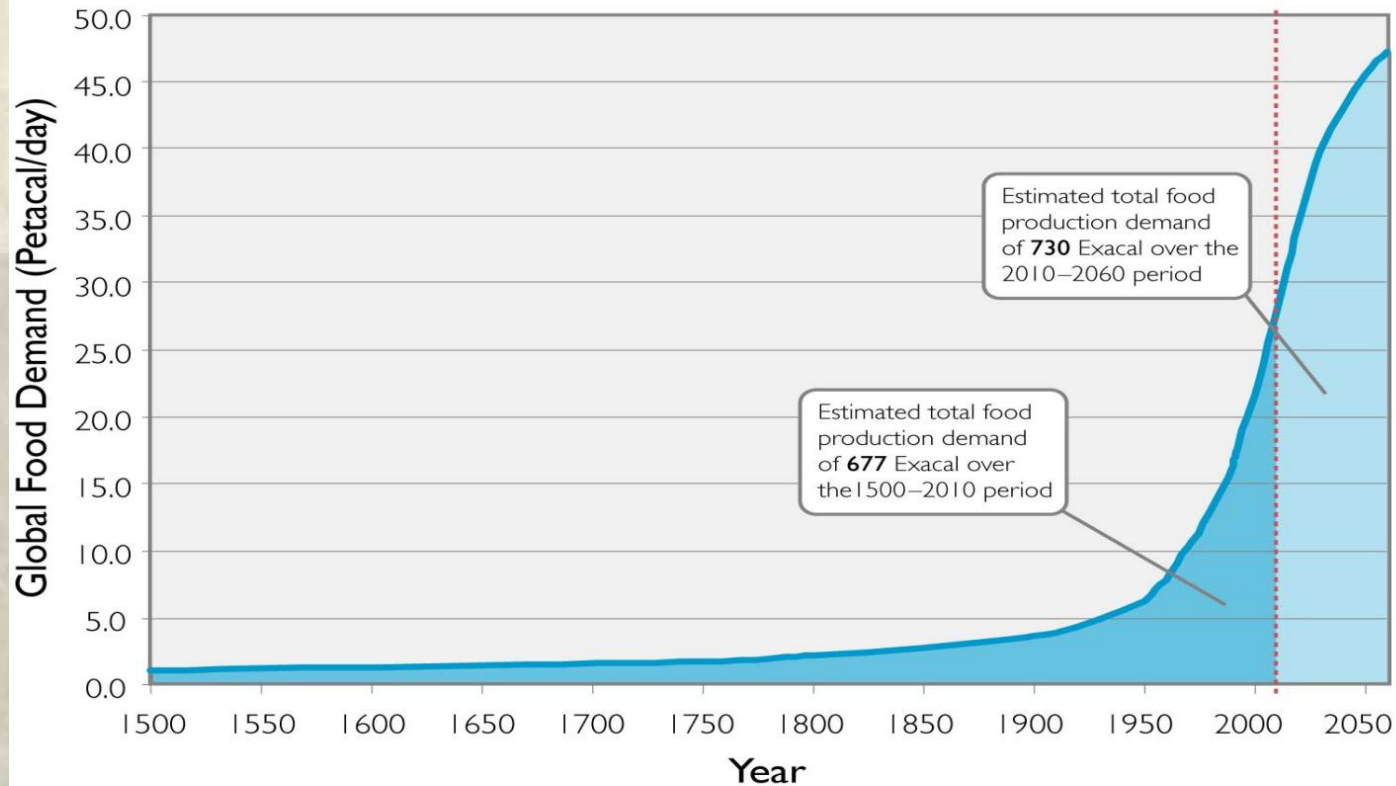
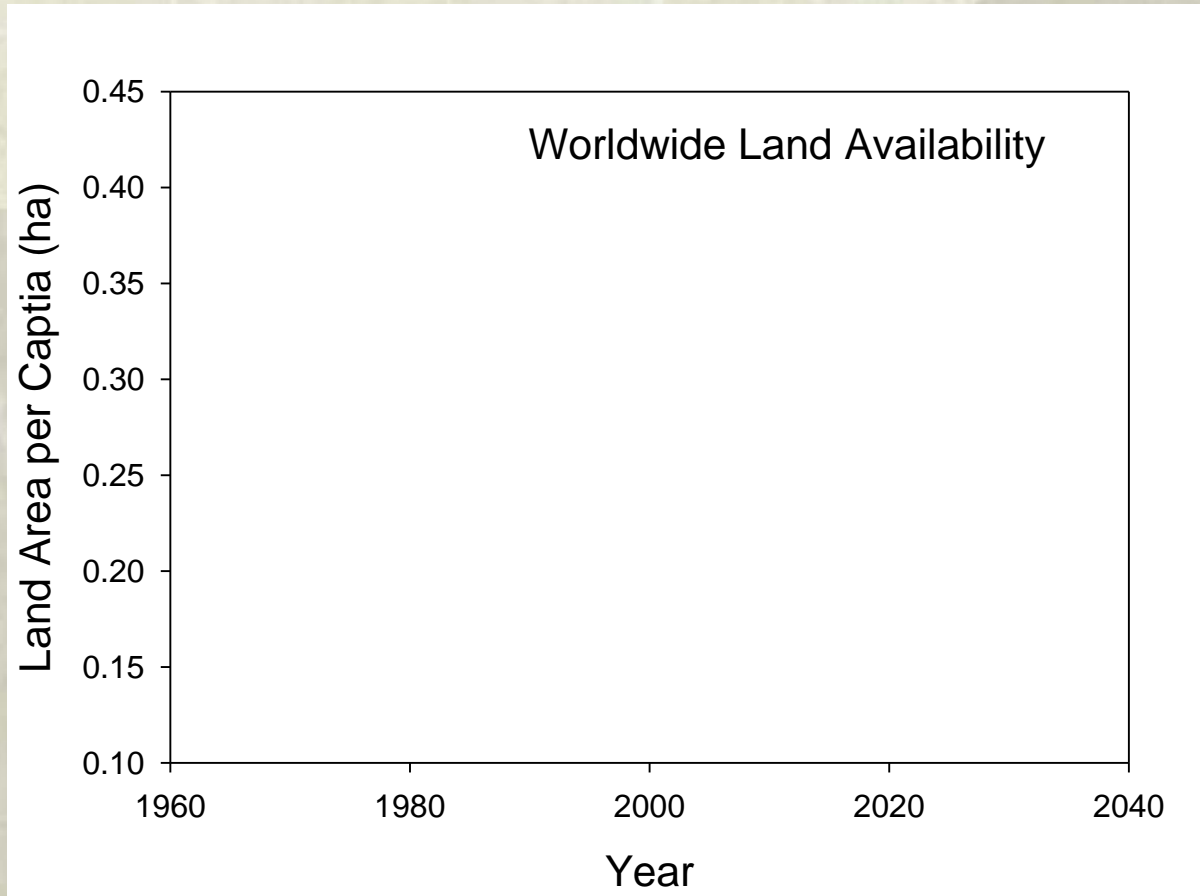


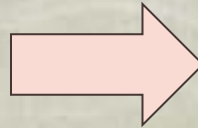
Figure 1. Explanatory notes:

- Based on data from FAOSTAT and UN Population Division, with simple scenario modelling from CSIRO 2009 (BA Keating, unpublished)
- Assumes growth trends in per capita food consumption growth in developing countries (currently 2668 kcal per capita per day) are maintained such that current developed country food consumption levels (3331 kcal per capita per day) are reached by 2050
- Assumes that diversion of food products (or production resources) to biofuels grows from current levels to 15% by 2050
- Assumes no food wastage prior to 1920 ramping up to current estimates of food wastage of 30% and these are not reduced going forward.
- A Petacal is 10^{15} calories, an Exacal is 10^{18} calories.

Worldwide Land Area

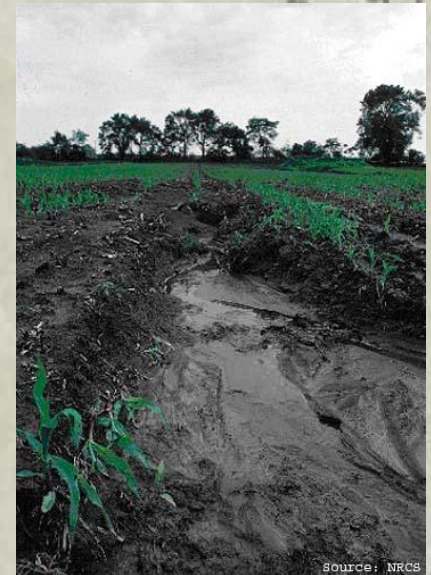
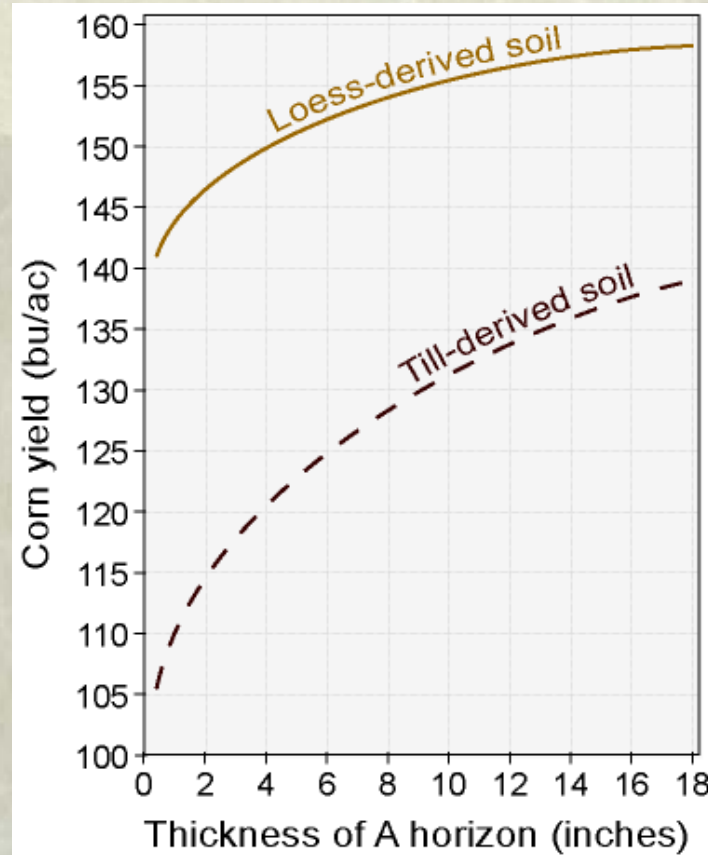


U.S. Agricultural Land Conversion



Are we losing ground?

Does soil erosion affect soil productivity?



Kazemi, Masoud, L.C. Dumenil, and T.E. Fenton. 1990. Effects of accelerated erosion on corn yields of loess-derived and till-derived soils in Iowa. Final report for Soil Conservation Service, Agreement No. 68-6114-0-8, Des Moines, IA.

At what rate do soils develop?

A study of rates of mineral soil formation in 18 watersheds around the world (parent materials were glacial till, schist, granite, and other noncarbonate rock) concluded average rates of soil formation were closer to

**0.24 tons per acre per year, with a range
of 0.01 to 0.8**

Alexander, E.B. 1988. Rates of soil formation: Implications for soil-loss tolerance. Soil Sci. 145:37-45

At what rate do soils develop?

“Data drawn from a global compilation of studies quantitatively confirm the long-articulated contention that erosion rates from conventionally plowed agricultural fields average 1–2 orders of magnitude greater than rates of soil production, erosion under native vegetation, and long-term geological erosion.*

*David Montgomery. 2007. Soil erosion and agricultural sustainability. Proceedings of the National Academy of Science. 104:13268 - 13272

How much soil erosion occurs?





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NRI Estimated Statewide Average

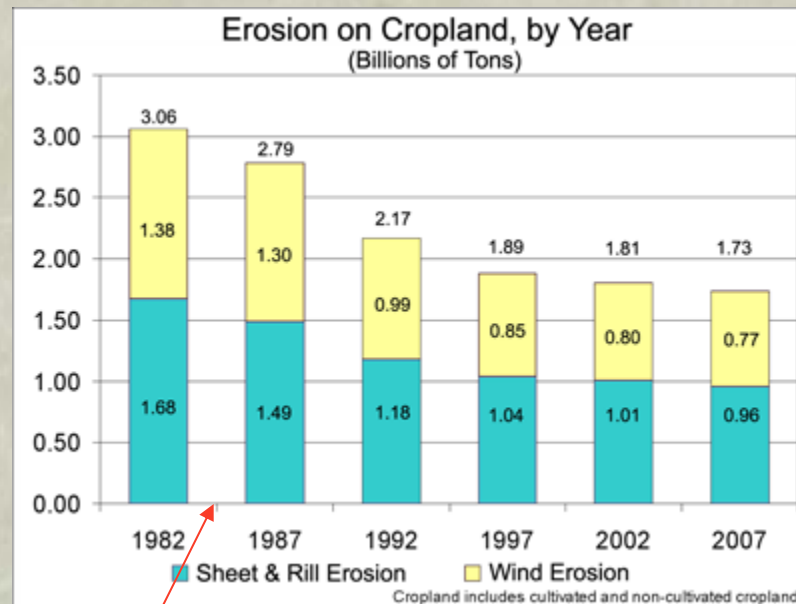
1982

❖ $7.7 \text{ T A}^{-1} \text{ YR}^{-1}$

2007

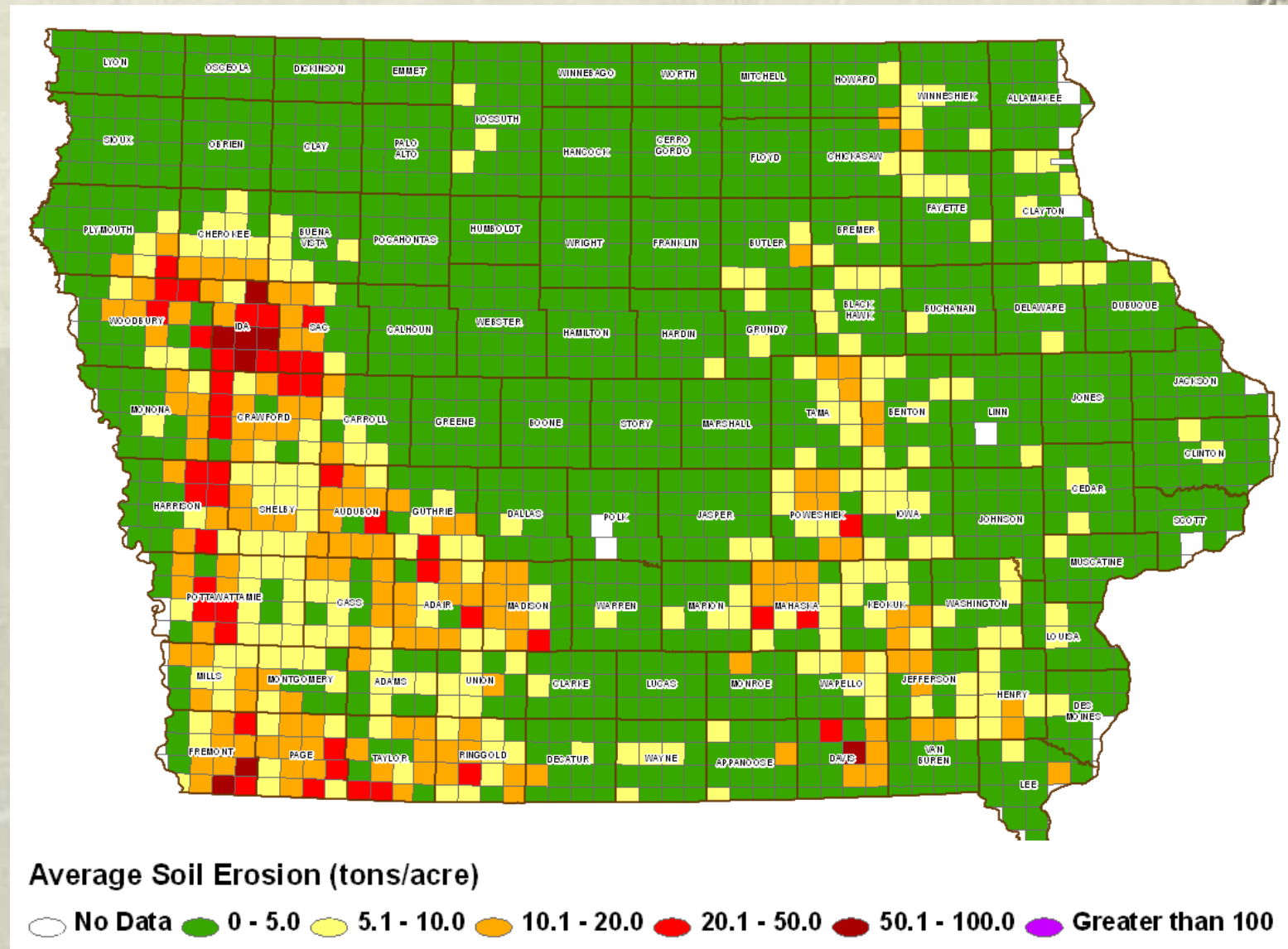
❖ $5.2 \text{ T A}^{-1} \text{ YR}^{-1}$

National Trend



CRP Established

Six million acres eroded at twice the “sustainable” rate in 2007.



Cox, Craig, Andrew Hug, and Nils Bruzelius. 2011. Losing Ground. Environmental Working Group. Available at: http://static.ewg.org/reports/2010/losingground/pdf/losingground_report.pdf

What Is Being Estimated?

- ❖ Sheet
- ❖ Rill



What Is Not Estimated?



How Do Farmers Respond to ↑ prices?

What is the impact on soil & water?

- ❖ Add more grass buffers?
- ❖ Bid in more CRP?
- ❖ Plant more diverse crop rotations?
- ❖ Eliminate tillage?
- ❖ Add riparian conservation practices?
- ❖ All of the above?
- ❖ None of the above?



Farmland Ownership

- “Nothing accelerates faster, stops quicker, or corners harder than a rented car”¹



¹Personal Communication – Trevor Price, Anheuser Busch distributor. 2006.



Weather and Climate Extremes in a Changing Climate

***Regions of Focus:
North America, Hawaii,
Caribbean, and U.S. Pacific Islands***

**U.S. Climate Change Science Program
Synthesis and Assessment Product 3.3**

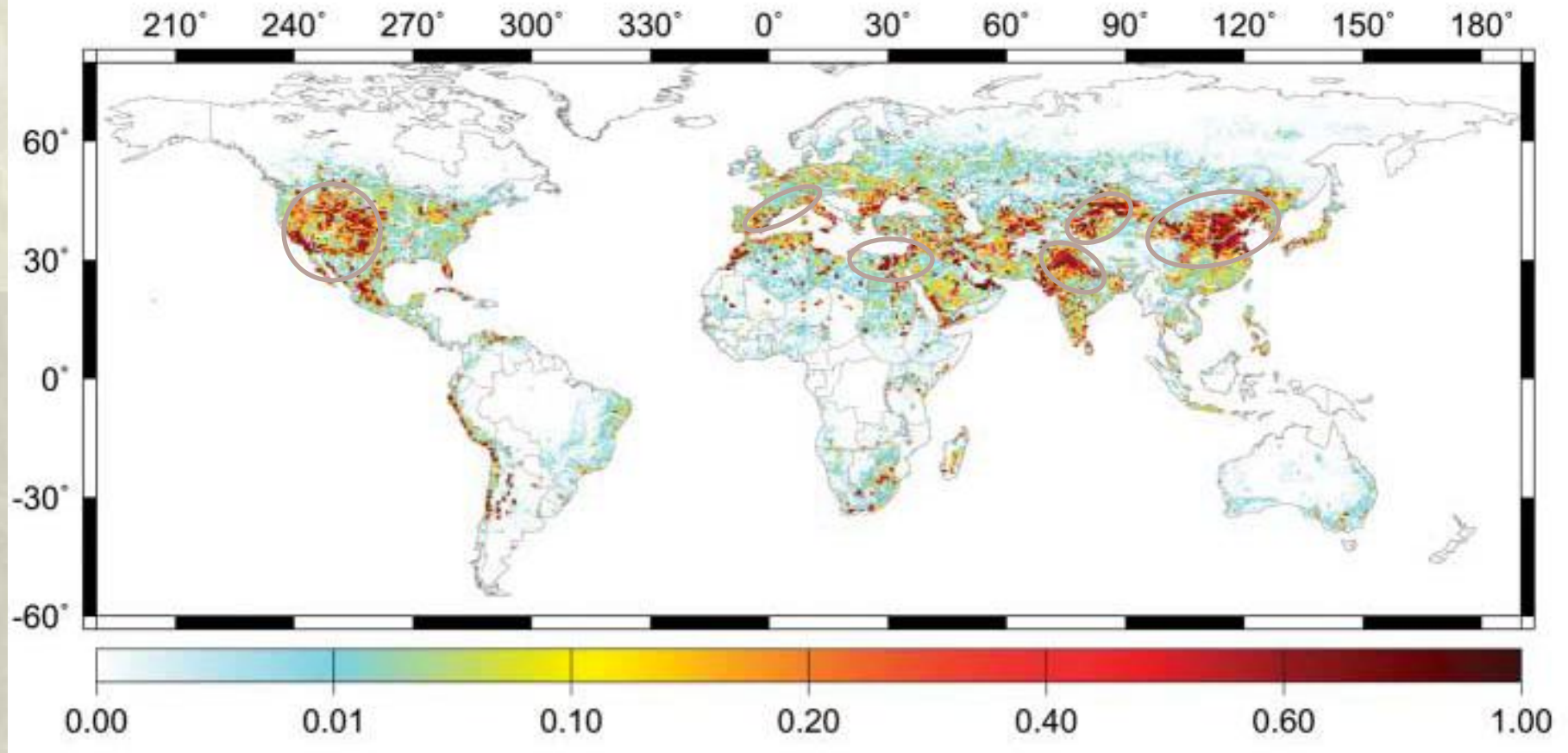
June 2008

“One of the clearest trends in the United States observational record is an increasing frequency and intensity of heavy precipitation events... Over the last century there was a 50% increase in the frequency of days with precipitation over 101.6 mm (four inches) in the upper midwestern U.S.; this trend is statistically significant “

Karl, T. R., J. M. Melillo, and T. C. Peterson, (eds.), 2009: Global Climate Change Impacts in the United States. Cambridge University Press, 2009, 196pp.

C

Water Scarcity Index



Oki, Taikan and Shinjiro Kanae. 2006. Global hydrological cycles and world water resources. *Science*. 313:1068-1072

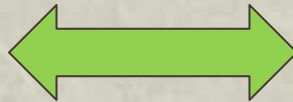
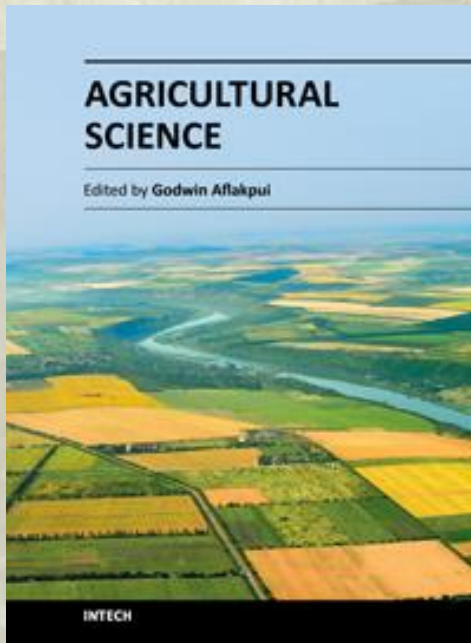
Irrigation

- ❖ ~ 40% of world food comes from 18% of world's cropland¹
 - India 3/5 of grain harvest
 - China 4/5 of grain harvest



¹W Danielle Nierenberg, Linda Starke and Erik Assadourian. 2007
State of the World – 2006. World Watch Institute.

What is the connection?
Is there a connection?



Incentives and Benefits

- ❖ What incentives do farmers have to sustain soil and water resources?
- ❖ What are the benefits to sustain soil and water resources?



What benefit exists for a car renter to check oil level?

What benefits exist for a car **owner** to check oil level?

Which has the greatest incentive?

WHY?

Are incentives and benefits for using conservation practices aligned?

❖ Absentee land owner

- Cash rent
 - Rental auctions
 - Highest bidder
- Term contracts

Are incentives and benefits for using conservation practices aligned?

❖ Farm program

– Crop insurance

- What benefits exist for diversification?
- Guaranteed income from marginal lands

❖ Land management companies

– Paid percent of gross return

Conclusions

- ❖ Soil is eroding faster than it is forming
- ❖ Soil erosion reduces crop yield
- ❖ Rainfall trends strongly suggest more erosive storms should be expected
- ❖ Ag structural components often do not favor conservation practice use

